



RAID Planning Guide

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Table of Contents

Chapter1 RAID Functions: An Introduction

1.1 Logical Drive	1-1
1.2 Logical Volume	1-2
1.3 RAID Levels.....	1-2
1.3.1 <i>NRAID</i>	<i>1-4</i>
1.3.2 <i>JBOD.....</i>	<i>1-4</i>
1.3.3 <i>RAID0.....</i>	<i>1-5</i>
1.3.4 <i>RAID1.....</i>	<i>1-5</i>
1.3.5 <i>RAID (0+1)</i>	<i>1-6</i>
1.3.6 <i>RAID3.....</i>	<i>1-7</i>
1.3.7 <i>RAID5.....</i>	<i>1-7</i>
1.3.8 <i>RAID6.....</i>	<i>1-8</i>
1.4 Spare Drives.....	1-9
1.4.1 <i>Local Spare Drives.....</i>	<i>1-9</i>
1.4.2 <i>Global Spare Drives.....</i>	<i>1-9</i>
1.5 Rebuild	1-11
1.5.1 <i>Automatic Rebuild.....</i>	<i>1-11</i>
1.5.2 <i>Manual Rebuild</i>	<i>1-12</i>
1.5.3 <i>Concurrent Rebuild in RAID (0+1).....</i>	<i>1-13</i>
1.6 Logical Volume (Multi-Level RAID).....	1-14
1.6.1 <i>What Is a Logical Volume?</i>	<i>1-14</i>
1.6.2 <i>Can Spare Drives Assigned to a Logical Volume?.....</i>	<i>1-17</i>
1.6.3 <i>Limitations:.....</i>	<i>1-17</i>
1.6.4 <i>Partitioning the Logical Drive or Partitioning the Logical Volume?</i>	<i>1-17</i>
1.6.5 <i>RAID Expansion with Logical Volume?</i>	<i>1-18</i>
1.6.6 <i>Different Configuration Settings Using Logical Volume?.....</i>	<i>1-19</i>
1.6.7 <i>A Logical Volume with Logical Drives of Different Levels?</i>	<i>1-19</i>

Chapter 2 RAID Planning

2.1 Considerations	2-1
2.1.1 <i>How many physical drives do you have?</i>	<i>2-1</i>
2.1.2 <i>Limitations? Does my OS or HBA support 64-bit LBA?.....</i>	<i>2-2</i>
2.1.3 <i>How many drives on each drive channel?.....</i>	<i>2-2</i>
2.1.4 <i>How many drives would you like to appear to the host computer?</i>	<i>2-2</i>
2.1.5 <i>What kind of host application?.....</i>	<i>2-3</i>
2.1.6 <i>Multi-path, hub, or switch?</i>	<i>2-3</i>
2.1.7 <i>Optimization mode</i>	<i>2-3</i>
2.1.8 <i>What RAID level?.....</i>	<i>2-4</i>
2.1.9 <i>Any spare drives?</i>	<i>2-4</i>
2.2 Configuring the Array	2-5
2.2.1 <i>Starting a RAID System</i>	<i>2-5</i>
2.3 Operation Theory	2-6
2.3.1 <i>I/O Channel, Host ID, and LUN</i>	<i>2-6</i>
2.3.2 <i>Grouping Drives into an Array</i>	<i>2-7</i>
2.3.3 <i>Making Arrays Available to Hosts</i>	<i>2-9</i>
2.4 Tunable Parameters	2-10

Chapter 3 Accessing the Array: Serial Port, Ethernet, and Access Security

3.1 RS-232C Serial Port	3-1
3.1.1 <i>Configuring RS-232C Connection via LCD Keypad Panel</i>	3-2
3.1.2 <i>Starting RS-232C Terminal Emulation</i>	3-3
3.2 Communication Parameters	3-4
3.2.1 <i>RS-232 Port Configuration</i>	3-5
3.2.2 <i>Terminal Emulation:</i>	3-6
3.2.3 <i>Baud Rate</i>	3-6
3.2.4 <i>Internet Protocol <TCP/IP></i>	3-6
3.2.5 <i>View Statistics</i>	3-7
3.2.6 <i>Set IP Address</i>	3-7
3.3 Out-of-Band via Ethernet	3-8
3.3.1 <i>What is the "Disk Reserved Space?"</i>	3-9
3.3.2 <i>Other Concerns</i>	3-10
3.3.3 <i>Connecting Ethernet Port:</i>	3-10
3.3.4 <i>Configuring the Controller</i>	3-10
3.4 Telnet Connection	3-11
3.5 Secure Link over SSH	3-12

About This Manual

This planning guide provides an overview of RAID introduction and planning. It offers useful background information to help you plan the installation of a RAID subsystem.

Who should read this manual?

This manual assumes that its readers are experienced with server hardware and software installation and are familiar with storage enclosures. After reading this guide, readers will be able to determine the appropriate components and the site requirements, and configure storage systems correctly.

Chapter 1	Introduces basic RAID concepts and configurations, including RAID levels, logical drives, spare drives, and the use of logical volumes. It is recommended that users unfamiliar with RAID technologies should read this chapter before creating a configuration.
Chapter 2	Tells the user how to begin with a RAID. At the beginning of this chapter, we raise some basic questions to which the user should know the answers prior to creating a RAID.
Chapter 3	Describes how to establish the management access to your RAID subsystem.

Revision History

- Initial release

Related Documentations

- Operation Manual
- RAIDWatch User's Manual
- Installation and Hardware Reference Manual

These two documents can be found in the product utility CD included with your subsystem package.

Conventions

Naming

From this point on and throughout the rest of this manual, the EonStor series is referred to as simply the “subsystem” or the “system” and EonStor is frequently abbreviated as “ES.”

Lists

Bulleted Lists: Bulleted lists are statements of non-sequential facts. They can be read in any order. Each statement is preceded by a round black dot “•.”

Numbered Lists: Numbered lists are used to describe sequential steps you should follow in order.

Important information that users should be aware of is indicated with the following icons:



NOTE:

These messages inform the reader of essential but non-critical information. These messages should be read carefully as any directions or instructions contained therein can help you avoid making mistakes.



CAUTION!

Cautionary messages should also be heeded to help you reduce the chance of losing data or damaging the system.



IMPORTANT!

The Important messages pertain to use the EonStor subsystem introduced in this manual.



WARNING!

Warnings appear where overlooked details may cause damage to the equipment or result in personal injury. Warnings should be taken seriously.

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1

RAID Functions: An Introduction

Redundant Arrays of Independent Disks, or RAID, offers the following advantages: availability, capacity, and performance. Choosing the right RAID level and drive failure management can increase capacity and performance, subsequently increasing availability. Infortrend's external RAID controllers and subsystems provide complete RAID functionality and enhanced drive failure management.

1.1 RAID Levels

Using a RAID storage subsystem has the following advantages:

- Provides disk spanning by weaving all connected drives into one single volume.
- Increases disk access speed by breaking data into several blocks when reading/writing to several drives in parallel. With RAID, storage speed increases as more drives are added as the channel bus allows.
- Provides fault-tolerance by mirroring or distributing parity across disk drives.

Table 1 - 1 A Brief on RAID Levels

RAID Level	Description	Capacity	Data Availability
NRAID	Non-RAID	N	None
RAID0	Disk Striping	N	Less than one single drive
RAID1 (0+1)	Mirroring Plus Striping (if N>1)	N/2	high ==RAID5
RAID3	Striping with Parity on dedicated disk	N-1	high ==RAID5
RAID5	Striping with interspersed parity	N-1	high ==RAID5
RAID6	Striping with P+Q (2 nd drive failure tolerance by redundantly distributed parity) interspersed parity	N-2	highest >>RAID5
RAID 10 (Logical Volume)	Striping with RAID1 logical drives	/	high >>RAID5
RAID 30 (Logical Volume)	Striping with RAID3 logical drives	/	high >>RAID5
RAID 50 (Logical Volume)	Striping with RAID5 logical drives	/	high >>RAID5
RAID 60 (Logical Volume)	Striping with RAID6 logical drives	/	highest >>RAID5



NOTE:

Drives on different channels can be included in a logical drive, and logical drives of different RAID levels can be used to compose a logical volume. There are more combinations than RAID 10, 30, and 50.

RAID Level	Performance Sequential	Performance Random
NRAID	Drive	Drive
RAID0	R: Highest W: Highest	R: High W: Highest
RAID1 (0+1)	R: High W: Medium	R: Medium W: Low
RAID3	R: High W: Medium	R: Medium W: Low
RAID5	R: High W: Medium	R: High W: Low
RAID6	R: High W: Medium	R: High W: Lower than RAID5

1.1.1 NRAID

Disk Spanning

NRAID stands for Non-RAID. The capacity of all drives is combined to become one logical drive (no block striping). In other words, the capacity of the logical drive is the total capacity of the physical member drives. NRAID does not provide data redundancy.

NRAID	
Minimum Disks Required	1
Capacity	N
Redundancy	No

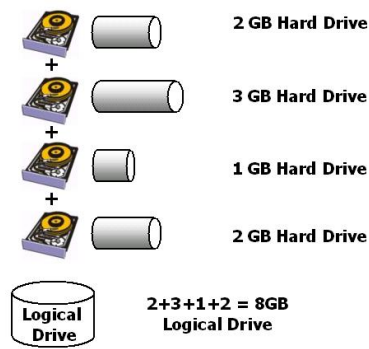


Figure 1 - 1 NRAID

1.1.2 JBOD

Single Drive Control

JBOD stands for Just a Bunch of Drives. The controller treats each drive as a stand-alone disk; therefore, each drive is an independent logical drive. JBOD does not provide data redundancy.

JBOD	
Minimum Disks Required	1
Capacity	1
Redundancy	No

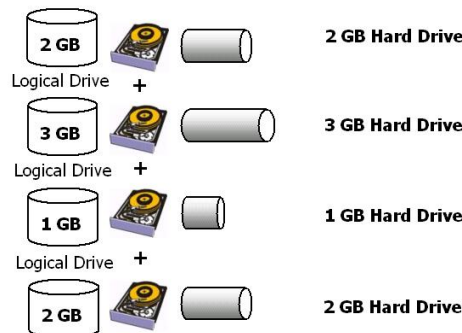


Figure 1 - 2 JBOD

1.1.3 RAID0

Disk Striping

RAID0 provides the highest performance but no redundancy. Data in the logical drive is striped (distributed) across several physical drives.

RAID0	
Minimum Disks Required	2
Capacity	N
Redundancy	No

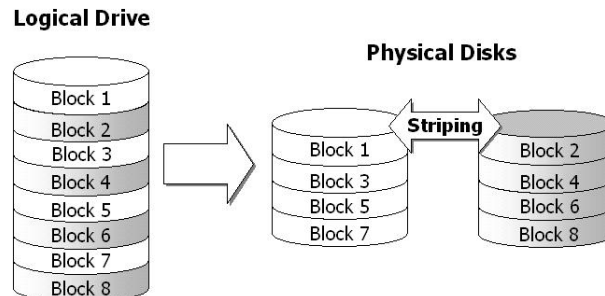


Figure 1 - 3 RAID0

1.1.4 RAID1

Disk Mirroring

RAID1 mirrors the data stored in one hard drive to another. RAID1 can only be performed with two hard drives. If there are more than two hard drives, RAID (0+1) will be automatically applied.

RAID1	
Minimum Disks Required	2
Capacity	N/2
Redundancy	Yes

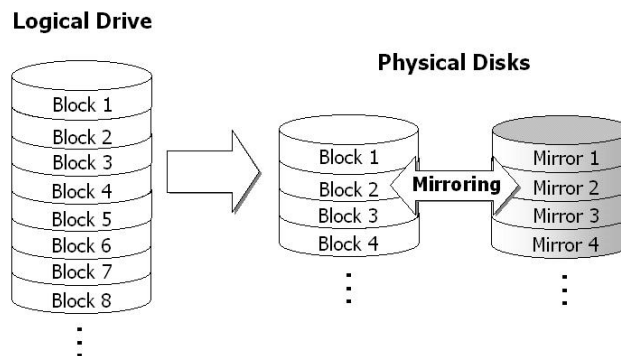


Figure 1 - 4 RAID1

1.1.5 RAID (0+1)

Disk Striping with Mirroring

RAID (0+1) combines RAID0 and RAID1 - Mirroring and Striping. RAID (0+1) allows multiple drive failure because of the full redundancy of the hard drives. If there are more than two hard drives assigned to perform RAID1, RAID (0+1) will be automatically applied.

RAID (0+1)	
Minimum Disks Required	4
Capacity	N/2
Redundancy	Yes

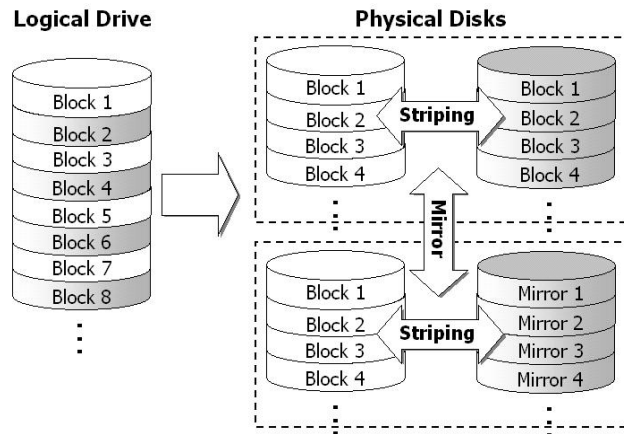


Figure 1 - 5 RAID (0+1)



IMPORTANT!

“RAID (0+1)” will not appear in the list of RAID levels supported by the controller. If you wish to perform RAID1, the subsystem will determine whether to perform RAID1 or RAID (0+1). This will depend on the number of drives that have been selected as the members of the logical drive.

1.1.6 RAID3

Disk Striping with Dedicated Parity Disk

RAID3 performs Block Striping with Dedicated Parity. One drive member is dedicated to storing the parity data. When a drive member fails, the controller can recover/regenerate the lost data of the failed drive by comparing and re-calculating data on the remaining drives.

RAID (0+1)	
Minimum Disks Required	3
Capacity	N-1
Redundancy	Yes

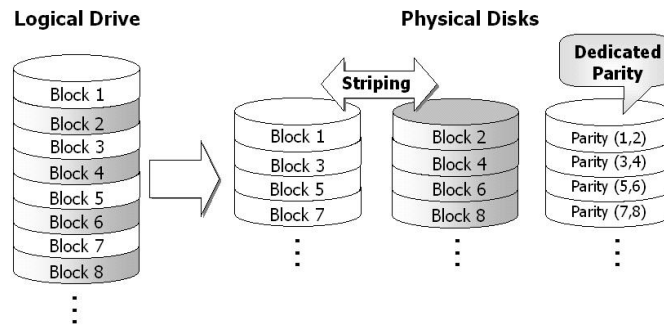


Figure 1 - 6 RAID3

1.1.7 RAID5

Striping with Interspersed Parity

RAID5 is similar to RAID3 but the parity data is not stored in a dedicated hard drive. Parity information is interspersed across the drive array. In the event of a drive failure, the controller can recover/regenerate the lost data of the failed drive by comparing and re-calculating data on the remaining drives.

RAID5	
Minimum Disks Required	3
Capacity	N-1
Redundancy	Yes

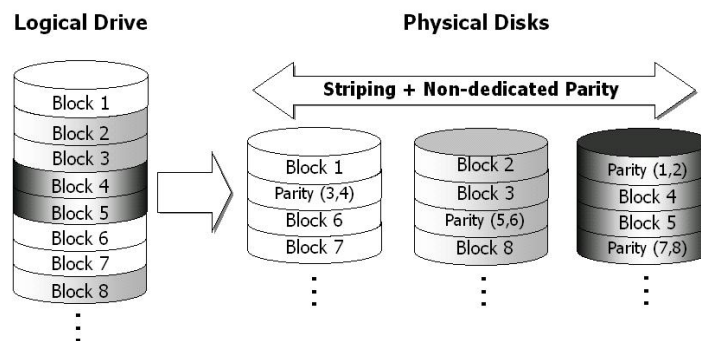


Figure 1 - 7 RAID5

1.1.8 RAID6

Striping with Redundant (P+Q) Parity Scheme

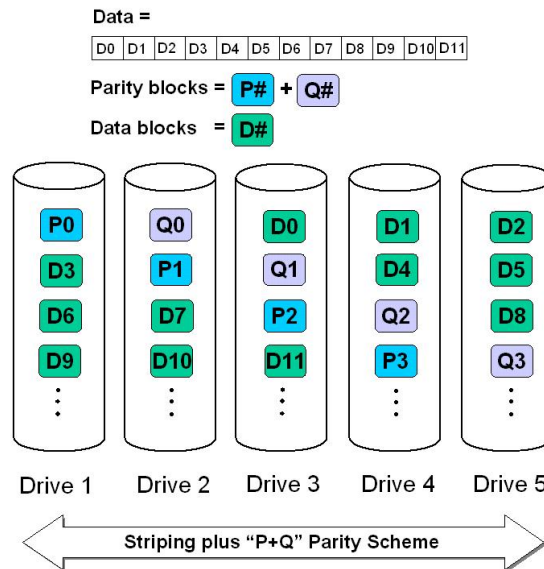


Figure 1 - 8 RAID6

RAID5 has been popular for it provides combined performance from its member drives and reasonable protection against single disk failure. However, when RAID subsystems grow larger and its applications more complex, the RAID5 protection can be insufficient. In the event of single drive failure, the occurrence of bad blocks on yet another member drive can render the affected data stripes unusable. RAID6 improves RAID5 and provides significantly higher redundancy level in terms of its ability to withstand two (2) of its member drives to fail at the same time.

RAID6	
Minimum Disks Required	4
Capacity	N-2
Redundancy	Yes
Withstands two drive failures, or one disk failure and bad blocks on another drive	

RAID6 is similar to RAID5 but two parity blocks are available within each data stripe across the member drives. Each RAID6 array uses two (2) member drives for storing parity data. The RAID6 algorithm computes two separate sets of parity data and distribute them to different member drives when writing to disks. This renders a RAID6 array to have one (1) drive capacity less than a RAID5 array containing the same number of member drives.

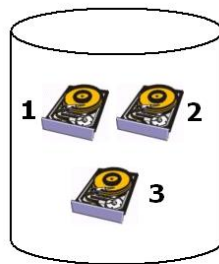
Each disk drive contains the same number of data blocks. Parity information is consequentially interspersed across the array following the preset algorithms. A RAID6 array can tolerate the failure of more than one disk drive; or, in the degraded mode, one drive failure and bad blocks on the other. In the event of disk drive failure, the controller can

recover/regenerate the lost data of the failed drive(s) without interruption to I/O access.

RAID 10, RAID 30, and RAID 50 are implemented as logical volumes; please refer to the proceeding discussions for details.

1.2 Logical Drive

The advantages mentioned above are achieved by creating “logical drives.” A logical drive is an array of independent physical drives. The logical drive appears to the host as a contiguous volume, the same as a local hard disk drive does.



Logical Drive

Figure 1 - 9 Logical Drive

The following section describes the different methods to create logical arrays of disk drives, such as spanning, mirroring and data parity. These methods are referred to as “RAID levels.”

1.3 Spare Drives

1.3.1 Local Spare Drives

A Local Spare Drive is a standby drive assigned to serve one specified logical drive. When a member drive of this specified logical drive fails, the Local Spare Drive becomes a member drive and automatically starts to rebuild.

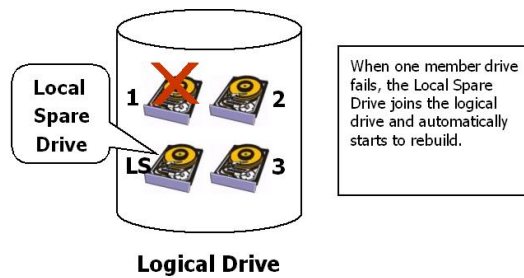


Figure 1 - 10 Local (Dedicated) Spare

1.3.2 Enclosure Spare Drives

An Enclosure Spare Drive serves more than one logical drive in a chassis. When a member drive of the logical drive fails, the Enclosure Spare Drive will start to rebuild for it. The Enclosure Spare Drive can only serve logical drives within the same chassis. Logical drives in different chassis will not be supported.

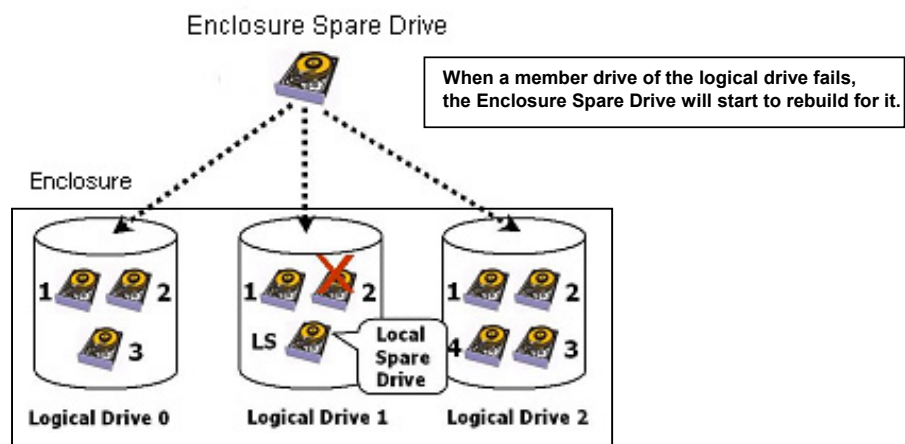


Figure 1 - 11 Enclosure Spare

1.3.3 Global Spare Drives

A Global Spare Drive serves more than one specified logical drive. When a member drive from any of the logical drives fails, the Global Spare Drive will join that logical drive and automatically start to rebuild.

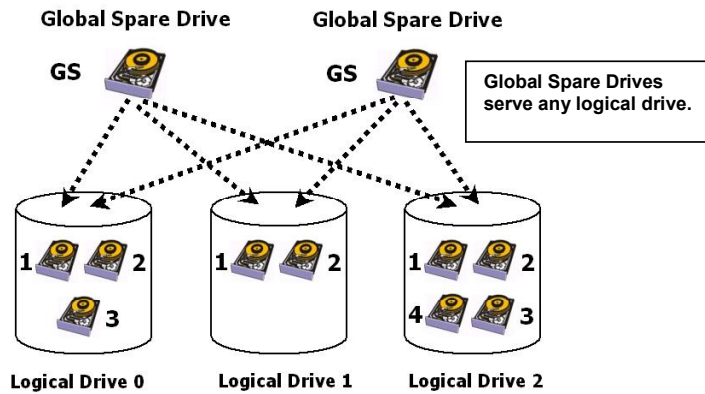


Figure 1 - 12 Global Spare

Figure 1-13 shows both Local Spare Drive and Global Spare Drive functions. On certain occasions, applying these two functions together will better fit various needs. Take note that the Local Spare Drive always has higher priority than the Global Spare Drive.

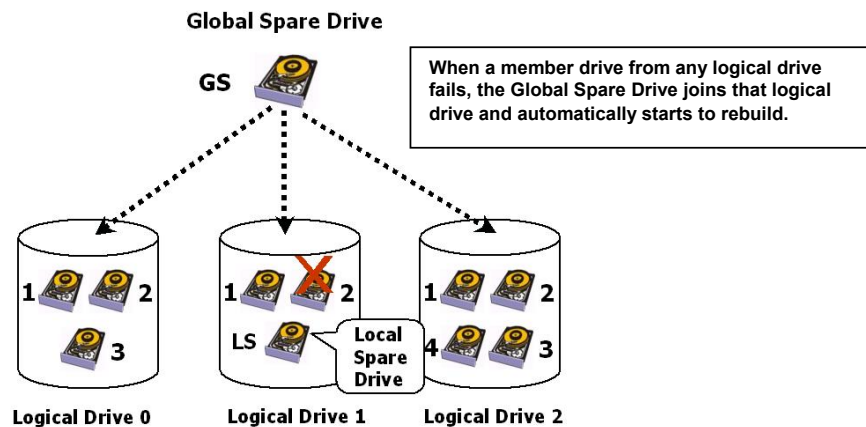


Figure 1 - 13 Global Spare Rebuild

In the example shown in Figure 1-14, the members of Logical Drive 0 are 9GB drives, and the members in Logical Drives 1 and 2 are 4GB drives.

It is not possible for the 4GB Global Spare Drive to join Logical Drive 0 because of its insufficient capacity. However, using a 9GB drive as the Global Spare Drive for a failed drive that comes from Logical Drive 1 or 2 will bring a huge amount of excess capacity since these logical drives require 4GB only. As shown on the left, the 9GB Local Spare Drive will aid Logical Drive 0 once a drive in this logical drive fails. If the failed drive is in Logical Drive 1 or 2, the 4GB Global Spare drive will immediately give aid to the failed drive.

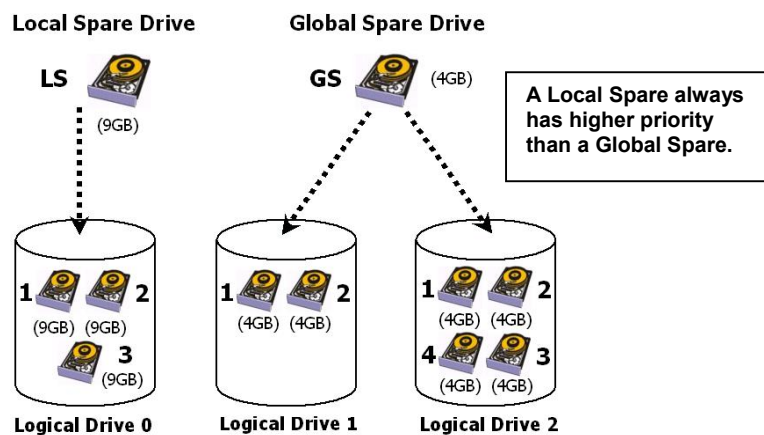


Figure 1 - 14 Mixing Local and Global Spares

1.4 Rebuild

1.4.1 Automatic Rebuild

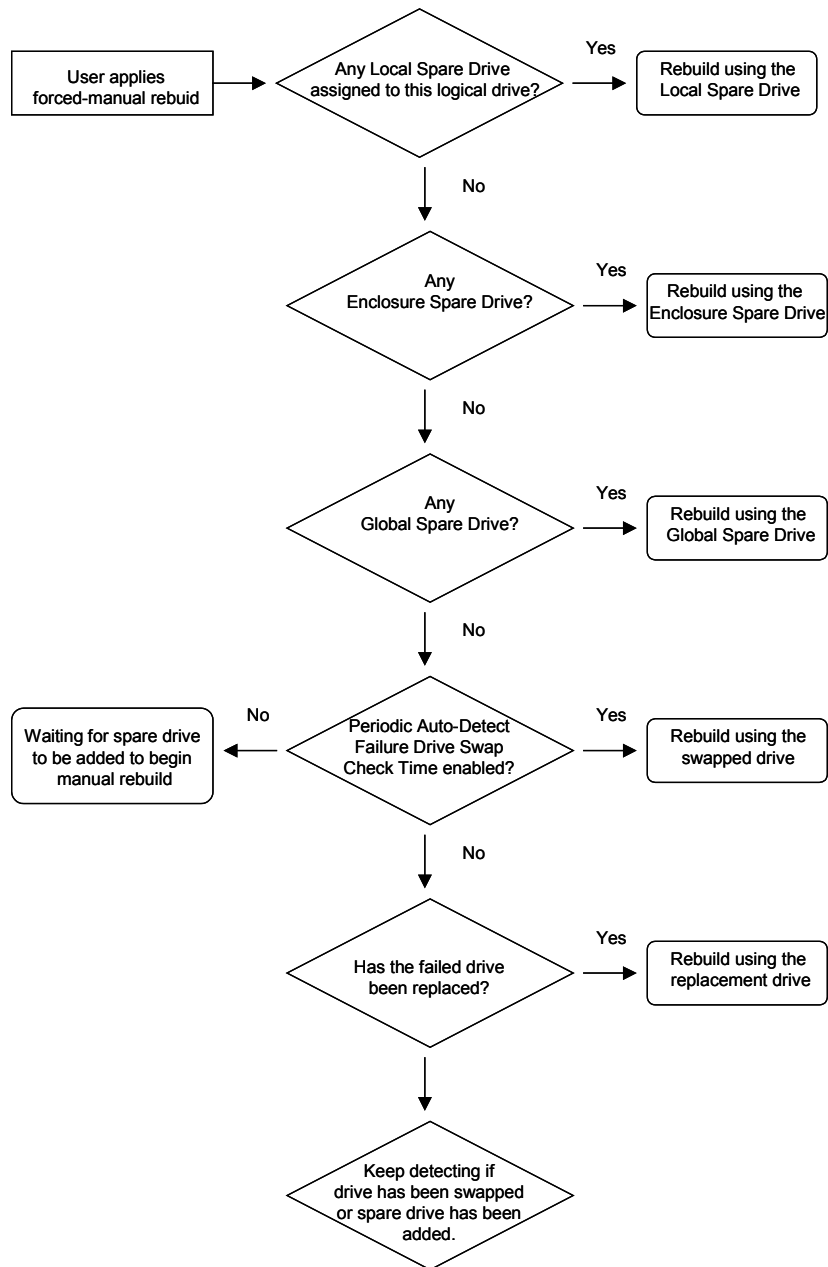


Figure 1 - 15 Automatic Rebuild

Rebuild with Spare: When a member drive in a logical drive fails, the controller will first examine whether there is a Local Spare Drive assigned to this logical drive. If yes, rebuild is automatically started.

If there is no Local Spare available, the controller will search for a Global Spare. If there is a Global Spare, rebuild automatically begins using the Global Spare.

Failed Drive Swap Detected: If neither a Local Spare Drive nor Global Spare Drive is available, and the "*Periodic Auto-Detect Failure Drive Swap Check Time*" is "Disabled," the controller will not attempt to rebuild unless the user applies a forced-manual rebuild.

When the "*Periodic Auto-Detect Failure Drive Swap Check Time*" is "Enabled" (i.e., a check time interval has been selected), the controller will detect whether a faulty drive has been swapped (by checking the failed drive's channel/ID). Once the failed drive has been replaced with a healthy drive, the rebuild will begin immediately.

If the failed drive is not swapped but a local spare is added to the logical drive, rebuild will begin with the spare.

If the S.M.A.R.T. function is enabled on drives and the reaction scheme is selected for securing data on a failing drive, the spare will also be used for restoring data. Please refer to *Operation Manual* for more details.

1.4.2 Manual Rebuild

When a user applies a forced-manual rebuild, the controller will first examine whether there is any Local Spare assigned to the logical drive. If yes, it will automatically start to rebuild.

If there is no Local Spare available, the controller will search for a Global Spare. If there is a Global Spare, logical drive rebuild will be automatically conducted.

If none of the spares are available, the controller will examine the SCSI channel and ID of the failed drive. Once the failed drive has been replaced by a healthy one, it starts to rebuild using the new drive. If there is no available drive for rebuilding, the controller will not attempt to rebuild until the user applies another forced-manual rebuild.

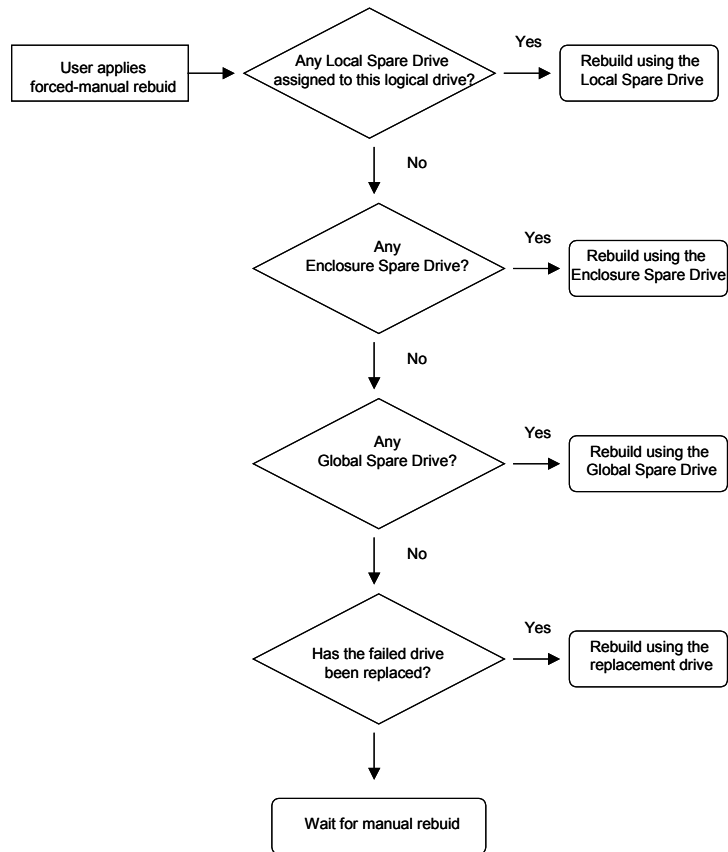


Figure 1 - 16 Manual Rebuild

1.4.3 Concurrent Rebuild in RAID (0+1)

RAID (0+1) withstands multiple drive failures with the condition that none of the mirrored pairs of data drives fails. (Two data drives mirroring each other must not fail together) Rebuilds can be automatically and concurrently conducted on more than one member if there is a sufficient number of pre-configured spare drives. Rebuild can also begin when the failed drives have been manually replaced. If failed drive detection has not been turned on, you may need to manually initiate the process.

1.5 Logical Volume (Multi-Level RAID)

The concept of a logical volume is very similar to that of a logical drive. A logical volume is the combination of one or several logical drives. These logical drives are combined into a larger capacity using the RAID0 method (striping). When data is written to a logical volume, it is first broken into data segments and then striped across different logical drives in a logical volume. Each logical drive then distributes data segments to its member drives according to the specific RAID level it is composed of.

The member logical drives can be composed of the same RAID level or each of a different RAID level. A logical volume can be divided into partitions. During operation, a host computer sees a non-partitioned logical volume or a partition of a logical volume as one single physical drive.

1.5.1 What Is a Logical Volume?

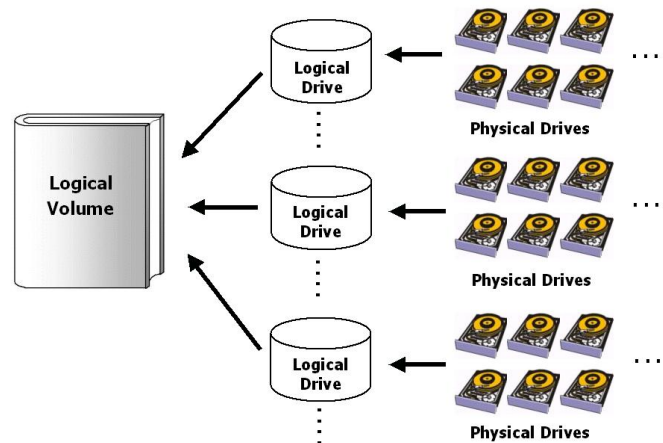


Figure 1 - 17 Logical Volume

A logical volume is a combination of RAID0 (Striping) and other RAID levels. Data written to a logical volume is first broken into smaller data segments and striped across different logical drives in a logical volume. Each logical drive then distributes data segments to its member drives according to its mirroring, parity, or striping scheme. A logical volume can be divided into a maximum of eight partitions. During normal operation, the host sees a non-partitioned logical volume or a partition of a partitioned logical volume as one single physical drive.

The benefits of using a logical volume are achieved by:

1. Extending the MTBF (mean time between failure) by using more redundancy drives (spare drives).
2. Decreasing the time to rebuild and reducing the chance of data loss caused by simultaneous drive failures because drives are included in different drive groups using a multi-level logical structure.
3. Avoiding the chance of data loss caused by channel bus failure with flexible drive deployment.

As diagramed below, numerous drives can be included in a logical drive, and one of them is used for redundancy. By grouping these drives into several logical drives, and then into a logical volume, the chance of two drives failing in a logical unit is greatly reduced. Each logical drive can have one or more local spares. A failed drive can be immediately replaced by a local spare, reducing the risk of losing data if another drive fails soon afterwards.

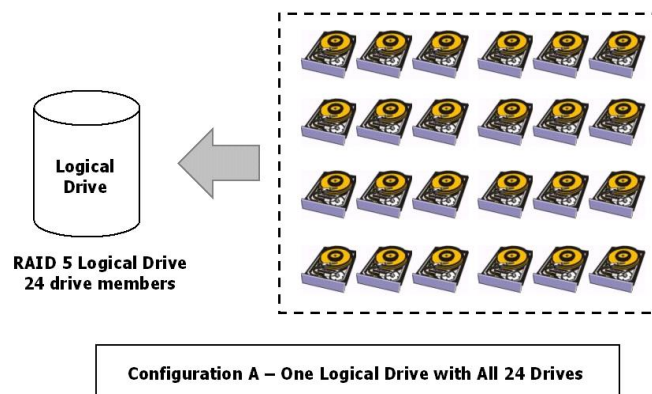


Figure 1 - 18 Logical Drive Composed of 24 Drives

As illustrated above, Configuration A is a RAID5 logical drive consisting of 24 physical drives. Configuration B is a logical volume made of four RAID5 logical drives.

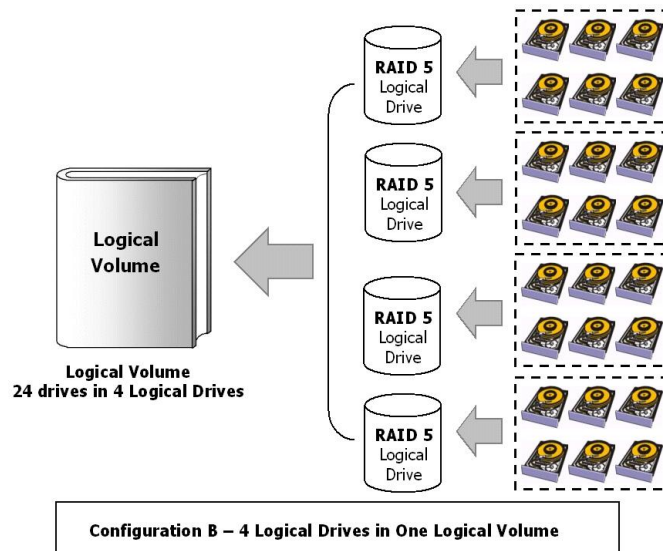


Figure 1 - 19 Logical Volume Composed of 4 Logical Drives Formed by 24 Physical Drives

Configuration B can help reduce the chance of encountering points of failure:

a) Higher Redundancy: Configuration A has one dedicated spare, while Configuration B allows the configuration of four spares. In Configuration B, the risk of simultaneous drive failure in a logical drive is significantly reduced compared to Configuration A. The total array capacity is comparatively smaller by the use of spares.

b) Less Rebuild Time: The time during rebuild is a time of potential hazard. For example, a RAID5 logical drive can only withstand single drive failure - if another drive fails during the rebuild process, data will be lost. The time span for rebuilding a faulty drive should be minimized to reduce the possibility of having two drives fail at the same time.

Configuration A is a large logical drive and takes a long time to rebuild. All members will be involved during the rebuild process. In Configuration B, the time span is shorter because only six members will participate when rebuilding any of the logical drives.

c) Channel Failure Protection: Channel failure may sometimes result from unlikely matters such as a cable failure. A channel failure will cause multiple drives to fail at the same time and inevitably lead to a fatal failure. Using a logical volume with drives coming from different drive channels can avoid this point of failure.

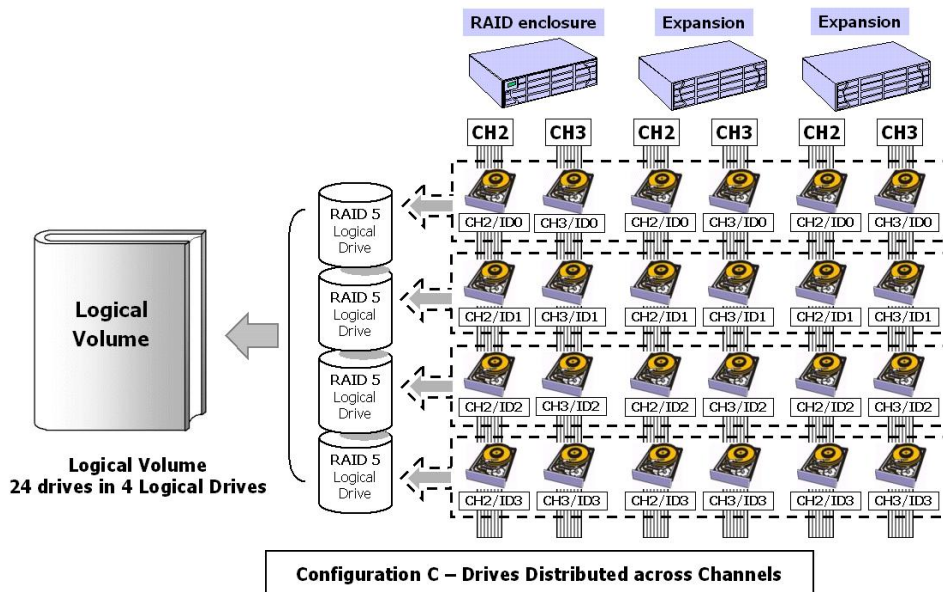


Figure 1 - 20 Logical Volume with Drives on Different Channels

As illustrated above, if one of the drive channels fails, each logical drive loses one of its members. Logical drives still have the chance to rebuild its members. Data remains intact and the rebuild can be performed after the failed channel is recovered. No access interruptions to the logical volume will be experienced from the host side.

1.5.2 Can Spare Drives be Assigned to a Logical Volume?

A Local Spare cannot be assigned to a Logical Volume. If a drive fails, it fails as a member of a logical drive; therefore, the controller allows a Local Spare's assignment to logical drives rather than logical volumes.

1.5.3 Limitations:

The logical volume can not have any logical drive stated as "fatal failed." If there is any failed drive in any of its member logical drives, the controller will start to rebuild that logical drive. If any of the member logical drives fail fatally, the logical volume fails fatally and data will not be accessible.

To avoid a logical volume failure:

1. Logical drives as members of a logical volume should be configured in RAID levels that provide redundancy, i.e., - RAID levels 1 (0+1), 3, 5, or 6.

2. Rebuild the logical drive as soon as possible whenever a drive failure occurs. Use of local spares is recommended.
3. A logical drive should be composed of physical drives from different drive channels. Compose the logical drive with drives from different drive channels to avoid the fatal loss of data caused by bus failure.

1.5.4 A Logical Volume with Logical Drives of Different Levels?

Multi-level RAID Systems

RAID (0+1) - this is a standard feature of Infortrend RAID controllers. It brings the benefits of RAID1 (high availability) and RAID0 (enhanced I/O performance through striping). Simply choose multiple drives (the number must be even; i.e., a multiple of two) to compose a RAID1 logical drive, and RAID (0+1) will be automatically implemented.

RAID (1+0) or RAID 10 - a logical volume is a multi-level RAID implementation. A logical volume is a logical composition, which stripes data across several logical drives (the RAID0 method). A logical volume with several RAID1 members can be considered as a RAID (1+0), or RAID 10 volume.

RAID (3+0) or RAID 30 - a logical volume with several RAID3 members.

RAID (5+0) or RAID 50 - a logical volume with several RAID5 members.

RAID (6+0) or RAID 60 - a logical volume with several RAID6 members.

1.6 Partitioning the Logical Volume

Once a logical drive has been divided into partitions, the logical drive can no longer be used as a member of a logical volume. The members of a logical volume should have one partition only with the entire capacity.

If you want to use a partitioned logical drive for a logical volume, delete the other partitions in this logical drive until there remains one partition only with the entire capacity. Note that deleting the

partition of the logical drive will also destroy all data. Data should be backed up before making partition configurations.

When a logical drive is used as a member of a logical volume, this logical drive can no longer be partitioned. Instead, the Logical Volume can be divided into eight partitions in RAID configuration.

The procedure for partitioning a logical volume is the same as that for partitioning a logical drive. After the logical volume has been partitioned, map each partition to a host ID/LUN to make the partitions available as individual drives.

As members of a logical volume, all logical drives will be forced to adopt a consistent write policy. Whenever the write policy of a logical volume is changed, for example, the corresponding setting in its members will also be changed. For information about Host ID/LUN mapping and write policy, please refer to *Operation Manual*.

1.7 RAID Expansion

The Logical Volume can also be expanded using the RAID expansion function. The concept of expanding a logical volume is similar to that of expanding a logical drive. To perform RAID expansion on a logical drive, replace each member physical drive with a drive of larger capacity or add a new drive, then perform logical drive expansion to utilize the newly added capacity. For information about RAID expansion, please refer to *Operation Manual*.

To perform RAID expansion on a logical volume, expand each member logical drive, then perform “RAID Expansion” on the logical volume.

Steps to expand a Logical Volume:

1. Expand each member logical drive.
2. Expand the logical volume.
3. Map the newly added capacity (in the form of a new partition) to a host LUN.



IMPORTANT!

- *If a logical unit has already been partitioned, and you wish to expand its capacity, the added capacity will be appended to the last partition. You will not be able to proceed with expansion using a firmware version earlier than 3.27 when the unit already has eight partitions.*
 - *Unless you move your data and merge two of the partitions, you will not be allowed to expand your logical volume. This is a precautionary limitation on logical unit expansion.*
-

1.8 Redundant Controller Assignment

Without logical volume - logical drives can be assigned to the primary or the secondary controller. The host I/Os directed to a logical drive will be managed by the controller which owns the logical drive. If a controller fails, the host I/Os originally assigned to the failed controller will be taken over by the existing controller. When the controller fails back (a failed controller is replaced by a new one), logical drives will be returned to the replacement controller in its original configuration.

With logical volume - logical volumes can also be assigned to different controllers. The only difference is logical volumes will be used as base units when shifting control during controller failure.

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RAID Planning

This chapter summarizes the RAID configuration procedures and provides some useful tools for first-time configuration:

- | | |
|----------------------------------|--|
| 2.1 Considerations | Things you should know before setting up the array |
| 2.2 Configuring the Array | The basic configuration procedure |
| 2.3 Operation Theory | A brief introduction to data bus and system drive mapping |
| 2.4 Tunable Parameters | A useful tool that gives you a glimpse of important parameters |

2.1 Considerations

By the time you understand the basic ideas behind RAID levels, you may still be wondering how to begin. Here are the answers to some questions that may help you through the decision making process.

2.1.1 How many physical drives do you have?

When initially creating the drive groups, you should know how many drives you have in your RAID system and in the expansion enclosure(s) or JBOD(s) attached to the RAID controlling unit.

2.1.2 Limitations? Does my OS or HBA support 64-bit LBA?

A maximum of 64TB capacity can be included in a single logical drive.

If you have a picture of large arrays in mind, make sure both your host OS and HBA support 64-bit LBA. Not all OSes and HBA cards support 64-bit LBA. Some OSes, such as SuSE Linux 9, Windows 2003, Linux kernel 2.6X, support the addressability. Your HBA must also support this feature. Please refer to the documentation that came with your OS and HBA card to ensure the support for this feature.

Up to 128 members can be included in each logical drive. However, extreme array sizes can cause operational problems with system backup or management and should be avoided.

2.1.3 How many drives on each drive channel?

Optimal system planning is always a compromise between pros and cons. As a general rule, the number of drives you should connect on each channel equals the data bus bandwidth divided by the maximum transfer rate you can get from each of your hard drives. Knowing the mechanical performance of your hard drives can also help to determine how many drives to connect over a drive channel.

Always use fast and large drives of the same capacity to compose a logical array. A logical drive composed of an adequate number of larger drives can be more efficient than a logical drive comprised of many but smaller drives.

2.1.4 How many drives would you like to appear to the host computer?

You must decide what capacity will be included in a logical configuration of drives, be it a logical drive, a logical volume, or a logical partition. A logical configuration of drives will appear to the host as a single capacity volume.

You may compose a large logical volume consisting of drives on different drive channels/enclosures, and have it divided into smaller partitions. These partitions are then associated with host channel ID/LUNs. Each logical partition will appear as an independent capacity volume.

2.1.5 What kind of host application?

The frequency of read/write activities can vary from one host application to another. The application can be a SQL server, Oracle server, Informix, or other database server of a transaction-based nature. Applications like video playback and

video post-production editing require read/write activities of large files coming in a sequential order.

Choose an appropriate RAID level for what is the most important for a given application – capacity, availability, or performance. Before creating your RAID, you need to choose an optimization scheme and optimize each array/controller for your application. Stripe size and write policy can be adjusted on a per logical drive basis.

2.1.6 Multi-path, hub, or switch?

Unpredictable situations like a cable coming loose can cause system down time. Fibre Channel redundant path configurations using a flexible LUN mapping method can guarantee there is no single point of failure. You may avail a logical drive on two separate host channels and let the multi-path software running on the host manage the access to this logical drive. The use of a Fibre Channel switch makes cabling and topology more flexible. Change host-side protocol and other associated settings to adjust the RAID array to your demands.

2.1.7 Optimization mode

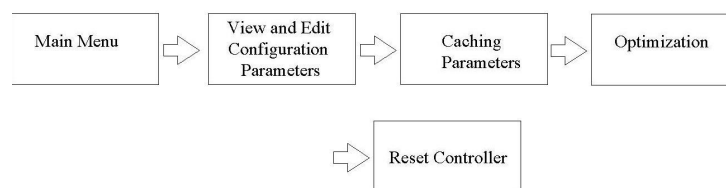


Figure 2 - 1: Optimization Setting

You should select an optimization scheme best suited to your applications before configuring a RAID array. Once the optimization mode is selected, it will be applied to all arrays in the system.

Two options are available: Sequential I/Os and Random I/Os. You may refer to the “Caching Parameters” section in *Chapter 5* and *Chapter 7* for the stripe size variables and their relation to RAID levels.

Numerous controller parameters are tuned for each optimization mode. Although stripe size can be adjusted on a per logical drive basis, users are not encouraged to make a change to the default values.

For example, smaller stripe sizes are ideal for I/Os that are transaction-based and randomly accessed. However, using the

wrong stripe size can cause problems. When an array of the 4KB stripe size receives files of 128KB size, each drive will have to write many more times to store data fragments of the size of 4KB.

The default values in optimization modes guarantee the optimal performance for most applications. Consult *Table 2-2* for all the controller parameters that are related to system performance and fault-tolerance.

2.1.8 What RAID level?

Different RAID levels provide varying performance features and fault tolerance levels. The RAID levels are fully explained in *Chapter 1*.

Data availability comes with the tradeoff that more processing power is consumed because the RAID subsystem needs to generate/retrieve parity data. For example, in a performance-oriented configuration without availability concerns, you may configure an adequate number of drives into one or several RAID0 logical drives to maximize the array performance.

2.1.9 Any spare drives?

(Swap Drive Rebuild / Spare Drive Rebuild)

Spare drives allow for the unattended rebuilding of a failed drive, heightening the degree of fault tolerance. If there is no spare drive, data rebuild has to be manually initiated by replacing a failed drive with a healthy one.

As is often ignored, a spare drive (whether dedicated or global) must have a capacity no smaller than the members of a logical drive.

2.2 Configuring the Array

2.2.1 Starting a RAID System

Here is a flowchart illustrating basic steps to be taken when configuring a RAID system. Hardware installation should be completed before any firmware configuration takes place.

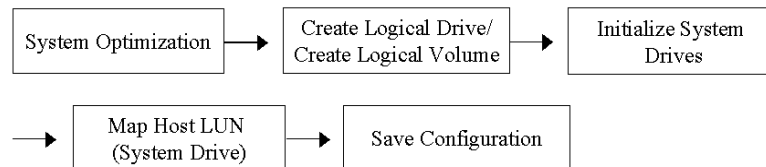


Figure 2 - 2: Array Configuration Process

Drives must be configured and the subsystem properly initialized before a host computer can access the storage capacity.

1. Use the LCD keypad panel, RS-232C terminal program, or the RAIDWatch manager to start configuring your array.
2. When powered on, the controller scans all the hard drives that are connected through the drive channels. If a SCSI hard drive is connected after the controller completes initialization, use the "Scan SCSI Drive" function (only on SCSI-based controllers or subsystems) to let the controller recognize its presence.
3. Optimize the controller's parameters for your host applications.
4. Configure one or more logical drives to contain your hard drives based on the requirements of the desired RAID level, and/or partition the logical drive or logical volume into two or more partitions.



NOTE:

- A "logical drive" is a set of drives grouped together to operate under a given RAID level and it appears as a single contiguous volume. For the maximum numbers of Logical Drives of each subsystem, please refer to Operation Manual.
- A "logical volumes" can be created each from one or several logical drives. A logical drive or logical volume can be divided into "Partitions." For the maximum numbers of Logical Volumes and partitions of each subsystem, please refer to Operation Manual.

5. The next step is to make logical drives or storage partitions available through the host ports. When associated with a host ID or LUN number, each capacity volume appears as one system drive. The host SCSI or Fibre adapter will recognize the system drives after the host bus is re-initialized.
6. The last step is to save your configuration profile in the host system drive (the use of RAIDWatch manager is necessary for this purpose) or to the logical drives you created.

The subsystem is independent from the host operating system. The host operating system will not be able to tell whether the attached storage is a physical hard drive or the virtual system drives created by the RAID subsystem.

2.3 Operation Theory

2.3.1 I/O Channel, Host ID, and LUN

Depending on the interface used by a RAID system, a SCSI channel (channel bus) can connect up to 15 drives (excluding the RAID controller itself). A Fibre Channel supports up to 126 drives in a loop. Depending on the subsystem design, a SCSI-based subsystem may have eight (8) disk drives connected through a drive channel while a SATA-based subsystem has one channel dedicated to each of its disk drive. Each device occupies one unique ID.

Figure 2-3 illustrates the idea of mapping a system drive to host ID/LUN combinations. The host ID is like a cabinet, and the drawers are the LUNs (LUN is short for Logical Unit Number). Each cabinet (host ID) contains up to 32 drawers (LUNs). Data can be made available through one of the LUNs of a host ID. Most host adapters treat a LUN like another device.

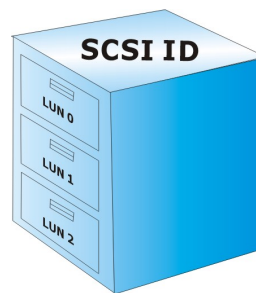


Figure 2 - 3: SCSI ID/LUNs

2.3.2 Grouping Drives into an Array

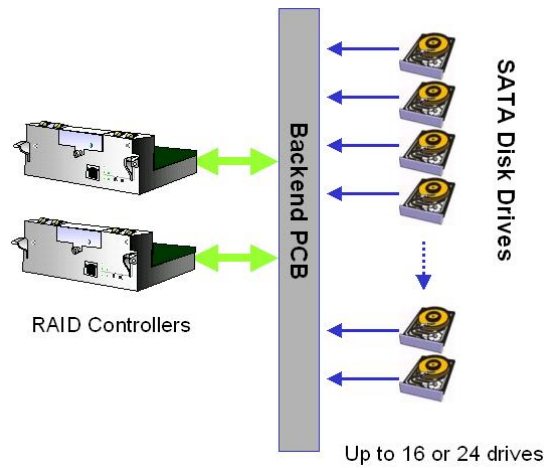


Figure 2 - 4: Connecting Drives

The logical view of the connection between RAID controller(s) and disk drives should be similar to the one shown above. Drives are connected through I/O paths on a back-end PCB that have been designated as drive channels.

The next diagram shows two logical configurations of drives and the physical locations of its members. There is no limitation on the locations of spare drives or drive members.

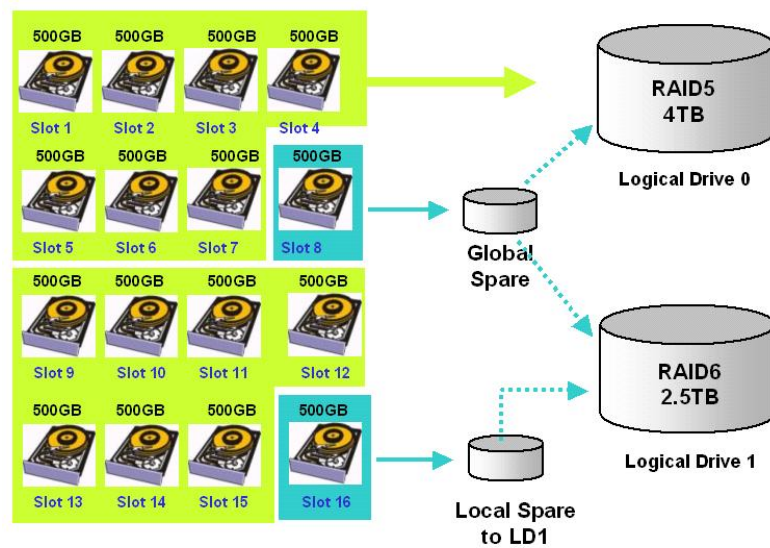


Figure 2 - 5: Physical Locations of Drive Members

A drive can be assigned as:

1. Local Spare Drive that serves one specific logical drive.
2. Enclosure Spare Drive that serves logical drives in the same chassis.
3. Global Spare Drive that participates in the rebuild of any logical drive.

Spares automatically joins a logical drive in order to replace a failed member when a drive fails. Spares are not applicable to logical drives that have no data redundancy (NRAID and RAID 0).

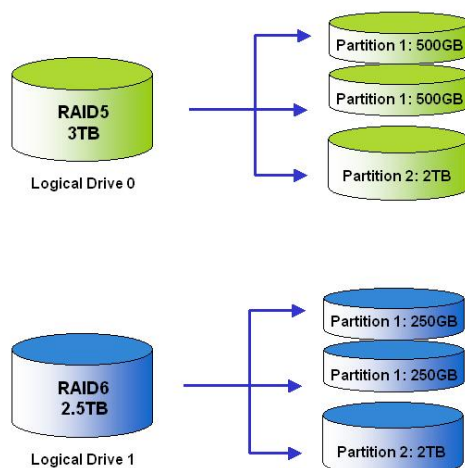


Figure 2 - 6: Partitions in Logical Configurations

You may divide a logical drive or logical volume into partitions of desired capacity, or use the entire capacity as a single volume.

1. It is not a requirement to partition any logical configuration. Partitioning helps to manage a massive capacity.
2. Note that a logical drive cannot be included in a logical volume if it has already been partitioned.

2.3.3 Making Arrays Available to Hosts

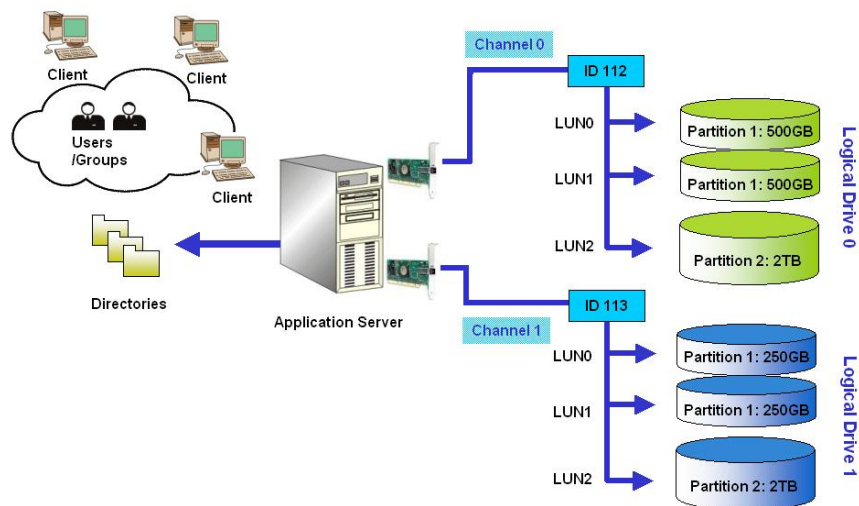


Figure 2 - 7: Mapping Partitions to Host ID/LUNs

Host ID mapping is a process that associates a logical configuration of drives with a host channel ID/LUN. To avail logical partitions on host channel(s), map each partition to a host ID or one of the LUNs under host IDs. Each ID or LUN will appear to the host adapter as one virtual hard drive.

There are alternatives in mapping for different purposes:

1. Mapping a logical configuration to IDs/LUNs on different host channels allows two host computers to access the same array. This method is applicable when the array is shared in a clustering configuration. Multi-path management software is required on the host side to avoid access contention.
2. Mapping partitions of an array to IDs/LUNs across separate host channels can distribute workload over multiple data paths.
3. Mapping across separate host channels also helps to make use of all bandwidth in a multi-path configuration. Firmware automatically manages the process when one data path fails and the workload on the failed data path has to be shifted to the existing data paths.

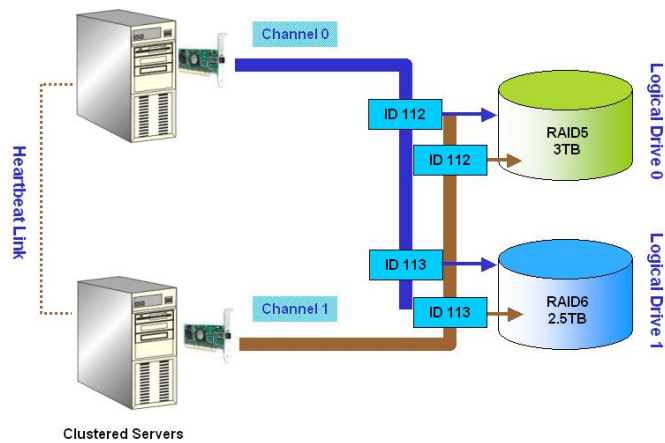


Figure 2 - 8: Mapping in a Multi-path Environment

2.4 Tunable Parameters

Fine-tune the subsystem and the array parameters for your host applications. Although the factory defaults guarantee the optimized operation, you may refer to the table below to facilitate tuning of your array. Some of the performance and fault-tolerance settings may also be changed later during the preparation process of your disk array.

Use this table as a checklist and make sure you have each item set to an appropriate value.

(1)	Parameters that should be configured at the initial stage of system configuration
(2)	Parameters that can be changed later
(3)	Non-critical

Table 2 - 1: Controller Parameter Settings

User-Defined Parameters	Default	Alternate Settings
Fault Management:		
(1) Automatic Logical Drive Rebuild - Spare Drive	Enabled when Spare Drive is available	RAID 1 + Local Spare RAID 3 + Local Spare RAID 5 + Local Spare RAID 6 + Local Spare Global Spare
(1) S.M.A.R.T.	Disabled	Detect Only Perpetual Clone Clone + Replace
(3) Clone Failing Drive	Manual function	Replace After Clone Perpetual Clone
(1) Rebuild Priority	Low (higher priority requires more system resources)	Low Normal Improved High
(1) Verification on Write	Disabled	On LD Initialization On LD Rebuild On Normal Drive Writes
(2) Periodic Cache Flush	Disabled	Continuous to 10 minutes
(2) Periodic Auto-Detect Failure Drive Swap Check Time	Disabled	Disabled, 5 to 60 seconds
(2) Periodic Drive Check Time	Disabled	Disabled, 0.5 to 30 seconds
(2) Rebuild Priority	Normal	Low, normal, improved, high

Controller:		
(1) Channel Mode	*	Host, Drive, RCCOM, Drive + RCCOM
(1) Host and Drive Channel IDs	*	*
(1) Controller Unique Identifier	Preset on some models	Hex number from 0 to FFFFF (FW 3.25 and above)
(2) Data Rate	Auto	Depends on problems solving
(1) Date and Time	N/A	
(1) Time Zone	+ 8 hrs	

Optimization Mode:		
(1) Write-back Cache	Enabled	Disabled
(1) Array Stripe Size	Related to controller general setting	4KB to 1024KB
(2) Adaptive Write Policy	Disabled	Enabled
(1) Optimization for Random/Sequential	Sequential	Either
(2) Array Write Policy	Related to controller general setting	W/B or W/T

Host- and Drive-side Parameters:		
(1) Data Transfer Rate	*	Host Side: Asynchronous to 4GHz Drive Side: Asynchronous to 3GHz
(1) Maximum Tag Count	32	1-128
(1) Maximum Queued I/O Count	32	1 to 1024
(2) LUN's per ID	8	Up to 32
(1) Periodic Drive Check Time	Disabled	0.5 to 30 sec
(1) Periodic Auto-Detect Failure Drive Swap Check Time	Disabled	5 to 60 seconds
(1) Number of Concurrent Host-LUN Connection	4	1 to 1024
(1) Tags per Host-LUN Connection	32	1 to 256
(1) Wide Transfer	*	Enabled/Disabled
(1) Drive I/O Timeout	7	0.5 to 30 seconds
(3) Drive Spindown Idle Delay Period	Disabled	60, 300, 600 sec
(1) Parity Check	Disabled	Enabled

Spin-Up Parameters: (available on SATA-based models)		
(1) Drive Motor Spin-Up	Disabled	Enabled
(1) Disk Access Delay Time	25 seconds; 30 seconds for specific SATA disk drives	No Delay, 5 to 75 seconds

Data Integrity:		
(3) Task Scheduler	N/A	Execute on initialization Start time and date Execution period Media scan mode Media scan priority Select Logical drive

Fibre Channel Parameters:		
(1) Fibre Connection Options	*	Loop Only Point-to-Point Only Auto
(1) Fibre Channel Dual-Loop	Enabled	Enabled by cabling connection
(1) Host ID/WWN Name List	*	User configurable
(1) RCC through Fibre Channel	*	Dedicated or sharing drive channel(s)

Array Configuration:		
(1) Disk Reserved Space	256MB	
(1) AV Optimization Mode	Disable	Fewer Streaming Multiple Streaming
(1) Max Drive Response Timeout	Disabled	160, 320, or 960ms
(2) Array Assignment	Primary controller	Secondary controller
(1) Array Partitioning	1	Up to 64
(1) Auto-assign Global Spare	disabled	enabled

Enclosure Monitoring:		
(2) Event Triggered Operation	N/A	Controller, fan, PSU, BBU, UPS, and elevated temperature Auto-shutdown: 2 mins~1 hour
(1) Thresholds for Voltage and Temperature Self-Monitoring	CPU temp: 0~90°C Board temp: 0~80°C 3.3V: 2.9~3.6V 5V: 4.5~5.5V 12V: 10.8~13.2V	User-defined; do not change parameters unless necessary

Others:		
(3) Password	N/A	User-Defined; Password Validation Timeout: 1 second to Always Check Configurable
(3) LCD Display Controller Name	N/A	User-defined
(1) UPS support	N/A	COM2 baud rate and related settings; event triggered operation
(1) Cylinder/Head/Sector Mapping	Variable	Depends on host OS

RAID Planning	1
2.1 Considerations	1
2.1.1 How many physical drives do you have?	1
2.1.2 Limitations? Does my OS or HBA support 64-bit LBA?	1
2.1.3 How many drives on each drive channel?	2
2.1.4 How many drives would you like to appear to the host computer?	2
2.1.5 What kind of host application?	2
2.1.6 Multi-path, hub, or switch?	3
2.1.7 Optimization mode	3
2.1.8 What RAID level?	4
2.1.9 Any spare drives?	4
2.2 Configuring the Array	5
2.2.1 Starting a RAID System	5
2.3 Operation Theory	6
2.3.1 I/O Channel, Host ID, and LUN	6
2.3.2 Grouping Drives into an Array	7
2.3.3 Making Arrays Available to Hosts	9
2.4 Tunable Parameters	10

Accessing the Array: Serial Port, Ethernet, and Access Security

This chapter describes how to establish the management access to your RAID subsystem. The main topics include the following:

- 3.1 RS-232C Serial Port**
- 3.2 Communication Parameters**
- 3.3 Out-of-Band via Ethernet**
- 3.4 Telnet Connection**
- 3.5 Secure Link over SSH**
- 3.6 Command-Line Interface**

3.1 RS-232C Serial Port

Infortrend's controllers and subsystems can be configured via a PC running a VT-100 terminal emulation program, or a VT-100-compatible terminal. RAID enclosures usually provide one or more DB-9 or audio jack RS-232C ports. Simply use an RS-232C cable to connect between the subsystem/controller's RS-232C port and the PC serial (COM) port.

Make sure you use the included null modem (IFT-9011) to convert the serial port signals. A null modem is always provided with your RAID subsystem/controller. The null modem has the serial signals swapped for connecting to a standard PC serial interface.

The following are guidelines on using the serial port:

- The serial port's default is set at 38400 baud, 8 bit, 1 stop bit and no parity. Use the COM1 serial port of the controller for terminal management session.
- In most cases, connecting RD, TD, and SG is enough to establish communication with a terminal.
- If you are using a PC as a terminal, any VT-100 terminal emulation software will suffice. Microsoft® Windows includes a terminal emulation program as presented with the "(Hyper) Terminal" icon in the Accessories window.
- For other details on connecting to the serial port, please refer to the *Installation and Hardware Reference Manual* that came with your subsystem.

3.1.1 Configuring RS-232C Connection via LCD Keypad Panel

The subsystem's baud rate default is set to 38400. If necessary, follow the steps below to change the baud rate using the front panel keypad:

Press **ENT** for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Configuration ..", then press **ENT**.

View and Edit
Config Parm's

Select "Communication Parameters ..", then press **ENT**.

Communication
Parameters ..

Select "RS-232 Configuration ..", then press **ENT**.

RS-232 port
Configuration ..

Select "COM1 Configuration ..", then press **ENT**.

COM1
Configuration ..

Select "Baud-rate XXXXX..", then press **ENT**.

Baud-rate 19200
..

The baud rate default is 38400. If another baud rate is preferred, press the up or down arrow keys to select the baud rate, then press **ENT** for 2 seconds to confirm the selected baud rate. Set the identical baud rate to your RAID array and your terminal computer.

Baud-rate 38400
Change to 19200?

- The following baud rates are available: 2400, 4800, 9600, 19200, and 38400.
- Terminal connection should work properly using the above setting. You may check the following option in your COM port configuration if you encounter problems:

“Term Emul. Enab ..”: Make sure the terminal function has not been accidentally disabled.

3.1.2 Starting RS-232C Terminal Emulation

The keys used when operating via the terminal are as follows:

- | | |
|------------|--|
| ← → ↑ ↓ | To select options |
| [Enter] | To go to a submenu or to execute a selected option |
| [Esc] | To cancel an option or return to the previous menu |
| [Ctrl]+[L] | To refresh the screen information |

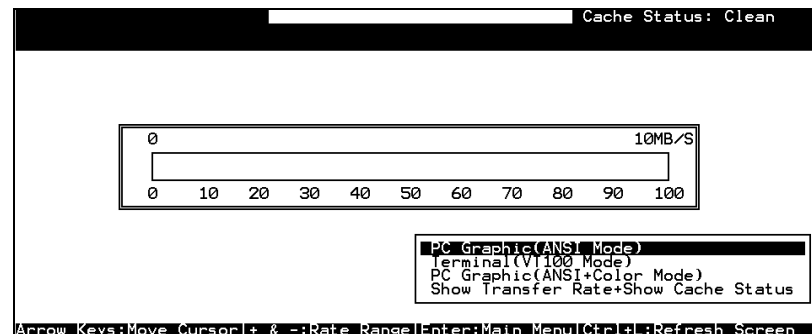


Figure 3 - 1: RS232C Initial Screen



NOTE:

If the RS-232C cable is connected while the controller is powered on, press [Ctrl] + [L] to refresh the screen information. Key combinations may vary depending on the terminal software you use.

The initial screen appears when the controller finishes its self-test and is properly initialized. Use ↑ ↓ arrow keys to select terminal emulation mode, then press [ENTER] to enter the Main Menu.

```
Fri Jul 5 17:55:12 2002          Cache Status: Clean
R0:42%                          BAT:+++++
                                < Main Menu >
Quick installation
view and edit Logical drives
view and edit logical Volumes
view and edit Host luns
view and edit Drives
view and edit channels
view and edit Configuration parameters
view and edit Peripheral devices
system Functions
view system Information
view and edit Event logs

Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen
```

Figure 3 - 2: Functional Item Page

Choose a functional item from the main menu to begin configuring your RAID.

3.2 Communication Parameters

The Communication Parameters is the first functional sub-menu you access once the physical RS-232C link is connected. In addition to the baud rate and terminal emulation options which have been discussed in section 3.1, the sub-menu contains several other options to prepare your management session using the Ethernet connection.

To access the sub-menu, use your arrow keys to select “View and Edit Configuration Parameters,” and press Enter on “Communication Parameters.” This provides menu accesses to “RS-232 Port Configuration” and “Internet Protocol <TCP/IP>.”

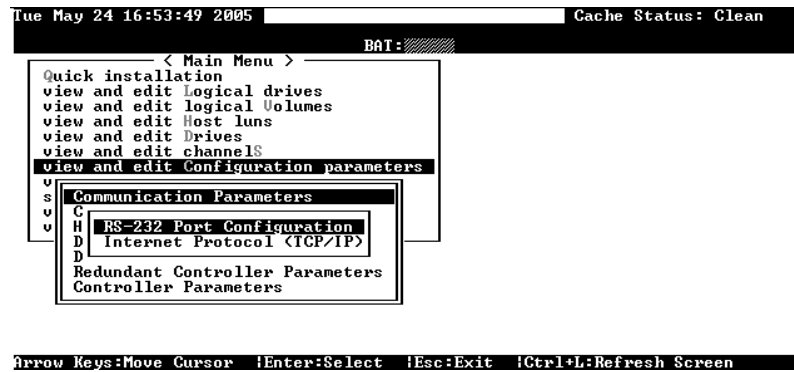


Figure 3 - 3: Configuration Parameters Page

3.2.1 RS-232 Port Configuration

The “RS-232 Port Configuration” provides access to change the COM port operating parameters. Each COM port (COM1 or COM2) selection menu features two communication parameters: “Baud Rate” and “Terminal Emulation.”

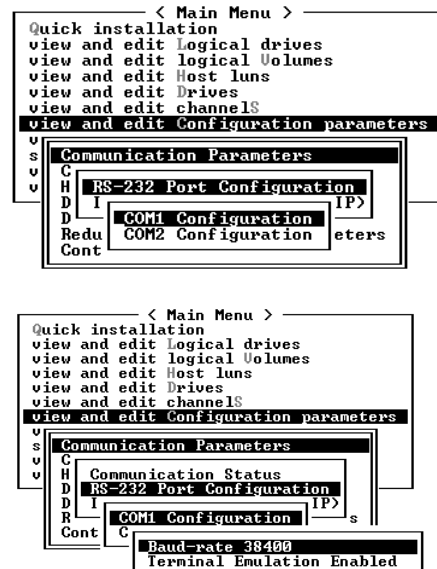


Figure 3 - 4: RS-232 Port Configuration Page



NOTE:

COM2 is mostly used for UPS connection on the EonStor subsystems. Unlike previous models, the COM2 port on the EonStor can no longer be used for management access.

3.2.2 Terminal Emulation:

The Terminal Emulation setting on the COM1 port is enabled by default. Usually there is no need to change this setting.

3.2.3 Baud Rate

To change the Baud Rate setting, select the highlighted menu item by pressing Enter. Available options will be displayed in a pull-down menu. Select by pressing Enter and press ESC several times to return to the previous configuration screen.

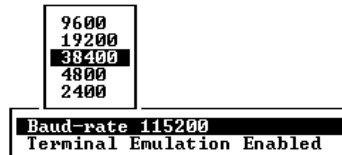


Figure 3 - 5: Baud Rate Setting Page

3.2.4 Internet Protocol <TCP/IP>

The Internet Protocol menu allows you to prepare the management access through the subsystem/controller's RJ-45 Ethernet port.

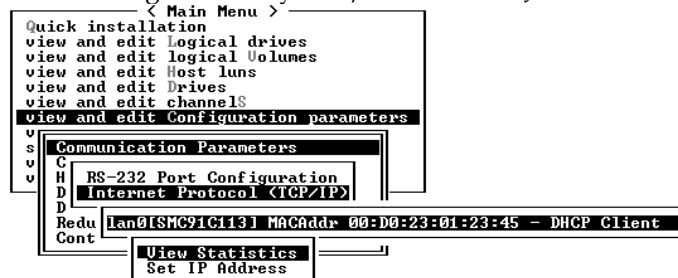


Figure 3 - 6: Internet Protocol Page

To access the configuration options, press Enter on "Internet Protocol <TCP/IP>" to display the information of Ethernet port. Press [ENTER] on the chip information to display the "View Statistics" and the "Set IP Address" options.

3.2.5 View Statistics

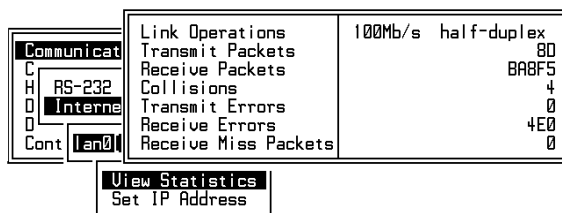


Figure 3 - 7: View Statistics Page

This window displays the current Ethernet link status.

3.2.6 Set IP Address

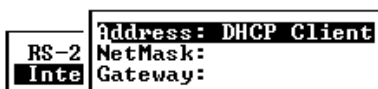


Figure 3 - 8: Internet Protocol Page

Provide a valid IP address for your subsystem/controller's Ethernet port. Consult your network administrator for an IP address and the associated NetMask and Gateway values. You may also key in "DHCP" if your local network supports automatic IP configuration.



NOTE:

One drawback of using DHCP is that if cable disconnection or other unpredictable network faults occur, your Ethernet port may be assigned with a different IP. This may cause problems for the management sessions using the RAIDWatch manager. You may not be able to receive important event messages. RAIDWatch and its sub-module, the Configuration Client (the event notification utility), recognize a configured array through its Ethernet port IP.

3.3 Out-of-Band via Ethernet

The RAIDWatch manager software provides a graphical interface to RAID subsystems. RAIDWatch comes with an installer program that facilitates the installation of software modules for local/remote access to the array through standard TCP/IP.

Below is a tree structure of RAIDWatch's installation options:

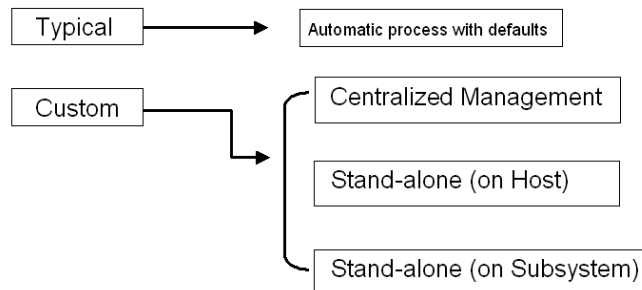


Figure 3 – 9: Installation Options

If you install RAIDWatch using the “*Typical*” option or the first two custom modes “*Centralized Management*” and “*Stand-alone (on Host)*,” prepare the following:

1. TCP/IP for the network connection to the controller/subsystem's Ethernet port.
2. Configure a valid IP and appropriate network settings for the RAID subsystem/controller's Ethernet port.

If you install RAIDWatch using the third installation option, “*Stand-alone (on Subsystem)*,” prepare the following:

1. TCP/IP for the network connection to the subsystem/controller's Ethernet port.
2. Configure a valid IP and appropriate network settings for the RAID subsystem/controller's Ethernet port.
3. Array reserved space: If you select the “Custom” installation mode, “Stand-alone (on Subsystem),” the RAIDWatch installation program will automatically create a reserved space on the first disk drive and distribute necessary program files to that space.
4. Unless the in-band connection over Fibre host busses is preferred, there is no need to configure the Peripheral Device setting with the later versions (2.1 and later) of RAIDWatch manager using Ethernet connection.

**NOTE:**

- Only the connections via Ethernet are discussed here. For more details about connections using the In-band method (the host-to-subsystem connection), please refer to the **RAIDWatch User's Manual** and **Chapter 9** of this manual.
- Unless you want to start using RAIDWatch under the following conditions, you must not configure the Peripheral Device settings:
 1. Using RAIDWatch to access a brand new array that has no configured drive groups.
 2. Using the In-band method (over the existing host data paths) for array management. The Peripheral Device settings present the RAID array on the host data paths as if it is an external device.

If you use an Ethernet link and then unnecessarily configure the Peripheral Device settings, the application servers will mistakenly identify the RAID array as an external device and request a driver. Normal RAID array operation does not require supporting drivers.

3.3.1 What is the “Disk Reserved Space?”

- If you install RAIDWatch using the third installation option, “Stand-alone (on Subsystem),” user's configuration data and the manager's main programs will be kept in a small section of disk space on a data drive.

After you create a logical drive, all its member drives will have a reserved space. The segregated disk space is called a “Disk Reserved Space.” When configuring a logical drive, the firmware automatically segregates 256MB of disk space from each of the member drives.

- In the event of a single controller failure within a dual-controller configuration, the surviving controller can continue the management access to the array because the RAIDWatch manager's main program is kept in the reserved space on the hard drives. Operators' access to the system will not be interrupted.
- The reserved space also allows “Drive Roaming.” Arrays (hard drives included in logical configurations) can be readily recognized by another RAID subsystem/RAID controller. This is useful when hardware faults occur, and you have to replace a faulty subsystem/controller.

3.3.2 Other Concerns

Availability Concern

The reserved space information can be seen during the array creation process or in the “View and Edit Drives” menu.

Whatever data is put into the reserved space, the firmware will automatically duplicate and distribute it to the reserved section on every data drive. Even if one hard drive or one logical drive fails, an exact replica still resides on other member drives.

Web-based Management

When firmware is installed on the stand-alone controller, once properly configured, the subsystem/controller’s Ethernet port behaves like an HTTP server. This applies to RAIDWatch’s third installation mode, “Stand-alone (on Subsystem).”

3.3.3 Connecting Ethernet Port:

Use a LAN cable to connect the Ethernet port(s) on the subsystem’s RAID controller unit(s). Connect the cables between subsystem/controller’s Ethernet port and an Ethernet port from your local network.

3.3.4 Configuring the Controller

To prepare the subsystem/controller for Ethernet connection:

1. Use a Terminal Emulator to Begin Configuration

Connect the subsystem’s serial port to a PC running a VT-100 terminal emulation program or a VT-100-compatible terminal.

Make sure the included null modem is already attached to enclosure serial port or the management computer’s COM port. The null modem converts the serial signals for connecting to a standard PC serial interface. For more details, please refer to the descriptions above in *Section 3.1* and *Section 3.2*.

2. Assign an IP Address to the Ethernet Port

Assign an IP address to the controller Ethernet port and specify the Net Mask and Gateway values. Power off your system and then power on again for the configuration to take effect.

Select "View and Edit Configuration Parameters" from the main menu. Select "Communication Parameters" -> "Internet Protocol (TCP/IP)" -> press [ENTER] on the chip hardware address -> and then select "Set IP Address."

You may also use an auto discovery protocol such as DHCP. Simply key in "DHCP" in the IP address field.

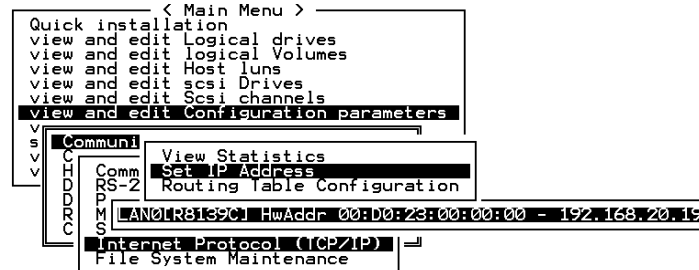


Figure 3 - 10: Set IP Address Page

Provide the IP address, NetMask, and Gateway values accordingly.

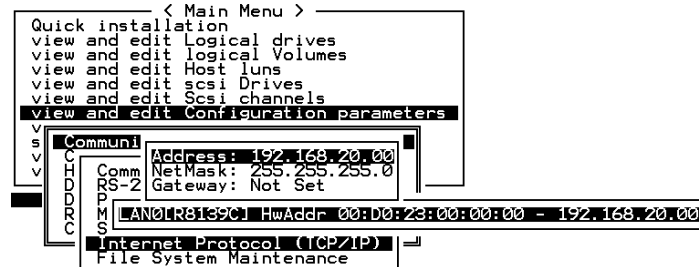


Figure 3 - 11: Provide IP Address Page

PING the IP address from your management computer to make sure the link is up and running.

3.4 Telnet Connection

1. Use an Ethernet cable with RJ-45 phone jacks to connect the Ethernet port on the subsystem/controller module.
2. Connect the other end of the Ethernet cable to your local area network. An IP address should be acquired for the subsystem's Ethernet port. The subsystem firmware also supports automatic client configuration such as DHCP.
3. Consult your network administrator for an IP address that will be assigned to the subsystem/controller Ethernet port.

4. Assign an IP address to the subsystem/controller's Ethernet port and specify the NetMask and Gateway values. Power off your system and then power on again for the configuration to take effect.
5. Select "View and Edit Configuration Parameters" from the main menu on the terminal screen. Select "Communication Parameters" -> "Internet Protocol (TCP/IP)" -> press **ENTER** on the chip hardware address -> and then select "Set IP Address."
6. Provide the IP address, NetMask, and Gateway values accordingly.
7. PING the IP address from your management computer to make sure the link is up and running.
8. Open a command prompt and key in "telnet <IP address>" to access the embedded firmware utility.

3.5 Secure Link over SSH

Firmware supports remote management over the network connection and the security under SSH (Secure Shell) protection. SSH is widely used for its ability to provide strong authentication and secure communications over insecure channels

To access the firmware embedded configuration utility over the SSH network, do the following:

1. Open a web browser.
2. Key in the line below in the browser's URL field.
`http://<controller IP>/ssh.html`
3. Enter controller name (if there is any) as user name and the password set for the RAID subsystem. If neither the controller name nor password has been set, press Enter at each command prompt to proceed.

3.6 Command-Line Interface

The command line interface provides the capability to monitor and configure Infortrend RAID Subsystems from an operating system command-line interface using in-band or out-of-band interfaces.

**NOTE:**

All methods that involve accessing a local device require superuser privileges. Users can invoke the command-line interface without being root only when an IP address is specified on the command line.

The management mode is determined based on the following:

- Out-of-Band Mode: If a host name or IP address is specified on the command line, it is used.
- In-Band Mode: If a local FC or SCSI device is specified on the command line, it is used.

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<i>Accessing the Array:</i>	1
<i>Serial Port, Ethernet, and Access Security</i>	1
3.1 RS-232C Serial Port	1
3.1.1 Configuring RS-232C Connection via LCD Keypad Panel	2
3.1.2 Starting RS-232C Terminal Emulation	3
3.2 Communication Parameters	4
3.2.1 RS-232 Port Configuration	5
3.2.2 Terminal Emulation:	6
3.2.3 Baud Rate	6
3.2.4 Internet Protocol <TCP/IP>	6
3.2.5 View Statistics	7
3.2.6 Set IP Address	7
3.3 Out-of-Band via Ethernet	8
3.3.1 What is the “Disk Reserved Space?”	9
3.3.2 Other Concerns	10
3.3.3 Connecting Ethernet Port:	10
3.3.4 Configuring the Controller	10
3.4 Telnet Connection	11
3.5 Secure Link over SSH	12
3.6 Command-Line Interface	12